[001] METHOD FOR THE OPERATION OF A POWER TRAVELING POWER TAKE-OFF SHAFT COUPLED TO A DRIVING MOTOR

[002] This application is a national stage completion of PCT/EP2005/001527 filed February 16, 2005 which claims priority from German Application Serial No. 10 2004 009 260.5 filed February 26, 2004.

[003] FIELD OF THE INVENTION

[004] The present invention concerns a method for the operation of a traveling, take-off power shaft connected to a drive motor by a clutch.

[005] BACKGROUND OF THE INVENTION

[006] Traveling power take-off shafts, appropriate to the state of the technology, have been installed in agricultural vehicles, for example in tractors, which have live axle connections, saddle supported distributors of fertilizer, drilling machines, and the like. In such cases, the traveling power take-off changes its rotation speed along with the traveling speed of the tractor, so that the speed of rotation of the take-off-shaft and the speed of the tractor remain continually in the same ratio, one to the other.

[007] In normal practice, power take-off shafts of this kind are clutch connected at the speed of rotation of the motor directly by means of predetermined gear stage ratios. For some applications in agricultural work, it becomes necessary to have, independent of the transmission ratio, a desired rotational speed ratio between the wheel and take-off power shaft, this being particularly true in cases of driving a trucking vehicle.

[008] According to the state of the technology, traveling power take-off shafts were connected to the output shaft by direct mechanical clutch. This practice resulted in excessive mechanical complexity. In this case – independent of the speed of rotation of the motor – a definite ratio was established between the speed of rotation of the wheels and the speed of rotation of the power take-off shaft.

[009] EP 0 511 480 B1 discloses a changeable transmission for the drive of a power take-off shaft as applied to a farm tractor, wherein an input shaft with at

least two driving gears, an output shaft with at least two free gears and an interposed, shiftable, sleeve clutch whereby the free gears are in continual mesh with the driving gears but free in respect to the input shaft. Between the driving gears is placed, in addition, a lamella clutch, which can be hydraulically activated. Moreover, at least one driving gear, located on each side of the said lamella clutch is rigidly bound to its housing.

[010] EP 0 967 107 B1 of the applicant, teaches a method for the control of a drive unit having a stepless, adjustable transmission. Upon the installation of this drive unit into a tractor with a power take-off drive, a gas pedal is provided to serve as a power lever and also present is a manual gas lever. During a period of active manual gas operation, the position of the said manual gas lever determines a control value for the drive motor. The position of the gas pedal demands a shift of the transmission ratio, so that, by means of the gas pedal the travel speed is fixed and by means of the manual gas lever, both the travel speed and the power take-off shaft rotational speed are controlled.

[011] The purpose of the present invention is to make a method available for the operation of a traveling power take-off shaft in clutch connection with a drive motor, which enables an interaction of the wheel and power take-off shaft by electronic means so that different ratios between the rotational speeds of the wheel and the traveling power take-off shaft can be obtained.

[012]

[013] SUMMARY OF THE INVENTION

[014] Accordingly, a method is proposed in the framework of which, the rotational speed of a traveling power take-off, through the speed of rotation of the drive motor, is caused to controllingly conform to the rotational speed of the wheels by electronic intervention. This can be achieved, for example, by the use of a sensor, which measures the rotational speed of the wheel, or by other tachometrical determinations in the down-gear transmission or even other driving speed sensors, which obtain, instead of the speed of rotation, the actual speed of travel. In this case, provision is made that the electronic system, upon the attainment of an

upper or lower threshold value of the motor, shifts into the next higher, i.e., the next lower gear stage of the power take-off shaft. For example, in a market of customary stages of 540, 750, or 1000 RPM, it is advantageously possible that a power take-off shaft operation can be achieved at vehicle speeds of 2.5 to 10 km/hr. The ratio of power take-off rotational speed to the rotational speed of the wheels would approximate 40/1.

[015] In a case, wherein the traveling power take-off shaft provides power to a self-driven trailer, the system must be able to start from speed "zero". In accord with the invention, provision is made, that the difference in the speeds of rotation between the speed of rotation at speed zero (i.e., until the lower threshold speed of rotation of the motor is reached) and the lower speed of rotation threshold of the motor are to be matched in a predesigned ratio by first, a proportional valve or second, by a step motor, or third by a reinforced, power take-off slip-clutch.

[016] Where driven trailers are a matter of concern, in accord with the invention, by means of wheel-slip know-how, it is possible, through an evaluation by the electronic system, to achieve an optimal ratio of speeds of rotation between the tractor and the trailer. This is particularly relevant in hilly country, where an assurance of safety is paramount.

[017] In accord with the invention, the possibility exists during vehicle travel, that with special applications, the ratio of the speed of the vehicle to the speed of rotation of the traveling power take-off shaft can be adjusted by manual intervention to meet current demands.